Appendix H

VEGETATION MANAGEMENT PRACTICES

This appendix describes the types of silvicultural systems, and associated harvest and reforestation methods and other vegetation management practices that may be chosen as individual projects are designed and implemented on the Forest. This information complies with CFR 219.15, which states, "The vegetation management practices chosen for each vegetation type and circumstance shall be defined in the forest plan with applicable standards and guidelines and the reasons for the choices." Vegetation types are described in five groups each having similar characteristics. All the circumstances that could exist throughout the Forest are extremely complex and variable and are generally grouped in forestwide and prescription area management direction. Specific vegetation conditions and circumstances will be addressed at the project level as needed. All Forest Plan standards that place limitations or restrictions on vegetation management apply to the vegetation management practices described in this Appendix.

SILVICULTURAL SYSTEMS AND METHODS

Silviculture is defined as the theory and practice, art and science of controlling the establishment, composition, growth, and quality of forest stands and trees, to meet the objectives of management (Smith 1962, p.1).

A silvicultural system is a planned series of treatments for tending, harvesting, and re-establishing a stand (Helms 1998). Within a silvicultural system, treatments are categorized as being regeneration cuttings and/or treatments, or intermediate cuttings and/or treatments. A regeneration cutting is defined as any removal of trees intended to assist regeneration already present or to make regeneration possible. An intermediate cutting/treatment is defined as any treatment or tending designed to enhance growth, quality, vigor, and composition of the stand after establishment or regeneration and prior to final harvest (Helms 1998).

Any of the methods and treatments described in this appendix may be used in any management prescription area where vegetation management is needed, regardless of whether the lands are suitable for timber production. However, a planned cycle of treatments does not occur on unsuitable timberlands. Actual treatment choices will be decided on a site-specific project basis.

Silvicultural Systems and Associated Harvest Methods:

Even-aged Silvicultural System: On the Daniel Boone, this system may be primarily used to replace stands of heavily damaged or otherwise undesirable trees. Harvest methods and site preparation within this system would leave reserve trees (residual trees from the previous stand) to meet standards for protection of the Indiana bat. The reserve trees would not be expected to put on significant growth or survive for an extended period of time, and the stand would eventually develop into an even-aged condition.

1. **Shelterwood** – Shelter and shade would be provided for a new age-class developing in a moderated microenvironment for a short period of time. Most of the shelterwood trees would be removed during one or more entries. In most cases, reserve trees and snags would be left for wildlife habitat.
2. **Seed tree** - Seed trees would provide a seed source for a short period of time until adequate regeneration is established. The seed trees may then be removed. In most cases, reserve trees and snags would be left for wildlife habitat.
3. **Clearcutting** – Essentially all woody plants would be cut (some harvested, some left) leaving a fully exposed microclimate for the development of a new age class. In most cases, reserve trees and snags would be left for wildlife habitat.

Two-aged silvicultural system: This system is likely to be the most commonly applied on suitable timberland. The reserve trees left in this system would be expected to grow and survive to the end of the next harvest entry, so that two cohorts (each having trees of similar age) would be present at all times. Data for growth and yield of two-aged stands is still being collected, but 20-year observations indicate that where the residual overstory is low, understory development is similar to that in clearcuts (Beck 1986).

1. **Shelterwood with reserves** - Shelter and shade would be provided for a new age-class developing in a moderated microenvironment. The shelterwood trees would be left to develop beyond physiological maturity through the "second" rotation. If available, certain reserve trees would be left for Indiana bat. Artificial regeneration may be used to initiate or supplement the development of the younger cohort.
2. **Seed tree with reserves** – reserves would provide both long-term structure as well as an initial seed source. Stand development would proceed in a similar manner as in the shelterwood with reserves method; however, initiation of the younger cohort would be from the seed trees.

Thinning: This intermediate treatment may be used in both the even-aged system and the two-aged system. It may be used to improve the vigor of trees, so they would be better able to resist the impact of natural agents such as insects and disease; or to influence growth of understory habitat. As in the past, timber sales having a significant amount of thinning may receive few bids if markets for small roundwood do not improve. Therefore, thinnings may be either commercial or non-commercial. Non-commercial thinnings will leave more woody material on the forest floor, which would become available for fire fuels during the period of time before decomposition.

Uneven-aged silvicultural system: Although not limited from use in any area where harvest is appropriate, this system is specifically prescribed within a small portion of the 1E Riparian Prescription Area. Three or more cohorts would be present, as a result of regeneration being initiated at various times as a result of repeated free thinning. A "reverse J" shape distribution should eventually develop in the stand, where the stand would contain a much smaller regeneration, a moderate amount of medium-size trees, and a small amount of large older trees.

1. **Singletree selection** - Canopy gaps may be created where individual trees are removed.
2. **Group selection** - Canopy gaps should be approximately twice the height of mature trees with smaller openings providing microenvironments suitable for shade tolerant regeneration and larger openings providing conditions suitable for more shade intolerant regeneration (generally less than ¼ acre for most stands).

Size of harvest areas: The maximum size of even-aged and two-aged regeneration areas is limited by forestwide standard to 40 acres. Intermediate treatment area or uneven-aged regeneration area maximum size is not limited. Any of the above methods may be spatially applied to areas smaller than stand size[2]. Although not specifically prescribed, cuttings in areas smaller than stand size and larger than group-selection openings may be useful to meet site-specific habitat needs.

Site Preparation and Reforestation methods: All chemical, fire, manual, and mechanical site preparation methods are available for use on the Forest, with a few limitations imposed by forestwide or prescription area standards.

Although mechanical site preparation methods have not been used widely in recent years on the Forest, use of this method is expected in reforestation of stands destroyed by the southern pine beetle. Constraints are placed on mechanical methods such as piling and windrowing, to minimize soil displacement.

In most cases, no site preparation treatments will be needed for uneven-aged systems, although fire or herbicide may be used to stimulate and/or control composition of regeneration and control weeds.

SILVICULTURE BY VEGETATION TYPE AND CIRCUMSTANCE

Silviculture in Steep and Mountainous Areas: From past experience, cable logging systems have proven to be unacceptable in single-tree selection or thinning harvests where a large number of residual trees remain, since much damage is done to the residual trees during log skidding. However, in most situations on the steep soils of the Forest, an adequate residual should be left to help prevent mass slumping and excessive erosion. Methods such as group selection, or small (less than one acre) strip clearcuts or small two-aged openings, may be appropriate for cable yarding or bench skidding on these sites.

Mechanical site preparation methods are not used frequently in the Southern Appalachian Mountains because areas of sustained gentle slopes are small and widely dispersed (USDA Forest Service 1989, p. 49-50). Not only is operation of the equipment difficult and often unsafe, mechanical site preparation methods that heavily disturb soil resources are not suitable on steep slopes where soil loss can occur. Manual and/or chemical site preparation methods may be appropriate and the only option for these sites.

Silviculture in Dry-Xeric and Dry-Mesic Oak-Hickory types on the Daniel Boone National Forest: The oak-hickory forest type is the most common and has been the most commonly regenerated type on the Forest. Both the clearcut and the shelterwood methods have proven to be effective in regeneration of the oak-hickory types on the Forest[3]. The two-aged system, using the shelterwood with reserve method has also proven to be effective in regenerating a new cohort of trees, although unacceptable mortality has occurred to the residual in some stands, possibly due to drought conditions which occurred following treatment. The uneven-aged system has not been used for regeneration of the oak-hickory type on the Forest for many years, although the uneven-aged system was added to the Plan by amendment in July 2000. This system is showing promising results in dry oak forests in Arkansas (Loewenstein 2000). It could be prescribed for this forest type to

[2]A stand contains trees of uniform composition and structure, in a contiguous area that is practical to map, typically at least 5 acres in size.

[3]Hardwood Stocking Surveys show that stands have been reforested within 5 years. Stand inventory records show young stands as being adequately stocked.

achieve habitat objectives, although a conservative approach should be taken until managers become comfortable with the application and results of the methods. The seed tree method is not a viable alternative in regenerating this type (SAF 1981). Since most reproduction in this type is from sprouts, seed existing in the duff, and advanced regeneration, the seed trees are normally of little value in reproduction.

Any site preparation method or combination of methods could be appropriate in this type, although timing and intensity of prescribed fire is probably a key factor in oak reproduction. On the Daniel Boone National Forest, without fire on these upland sites, dogwood, red maple, blackgum, and shrubs often dominate young stands. Regardless of harvest or site prep method, without repeated fire and advanced oak regeneration, the percentage of oak component is often reduced in the resulting stand. A "shelterwood-burn" technique could be used to assure a new oak forest. Burning could continue for several years following an initial light shelterwood harvest, until oak dominates the advance regeneration pool (Van Lear et al. 2000). Continued short-return fire would cause the development of oak savanna. Therefore if oak-hickory forest is the desired condition, following the development of a dominance of oak regeneration, fire (and other disturbance) should be excluded for several years to allow growth of bark for protection of the cambium layer of young trees.

Silviculture in Yellow pine and Yellow pine-hardwood types on the Daniel Boone National Forest: Yellow pine and yellow pine-hardwood forest types have declined in recent years and much regeneration of this type is planned. In the even-aged system, both the clearcut and the seed-tree methods have proven to be effective in regeneration of these types on the Forest[4]. When pine seed-trees are available, the two-aged system, using the seed-tree with reserves method has also proven to be effective in regenerating a new cohort of pine when seedbed and moisture conditions are favorable. Although yellow pine is well adapted to fire, occasional mortality can occur to the seed-trees if the site preparation fire becomes too intense. A two-aged system using a shelterwood with reserves may also be used which would result in an older hardwood residual over a younger planted pine/natural hardwood cohort. There are no records of an uneven-aged system having been used for regeneration of yellow pine or yellow pine-hardwood types on the Forest. It has generally been thought that shade-intolerant pine regeneration would not compete well in a shady uneven-aged condition. However in a study on the Ouachita National Forest, shortleaf pine was successfully regenerated and grown in uneven-aged condition developed using singletree selection (Shelton & Murphy, 1997). The study concluded that the system works best when the overstory is kept open, and higher proportions of pine are maintained. "Hardwoods apparently suppress the development of pine seedlings to a greater degree than do an equivalent basal area of pines." On the Daniel Boone an uneven-aged system could be prescribed for these forest types to achieve habitat objectives, although a conservative approach should be taken until managers become comfortable with the method application and results.

Any site preparation method or combination of methods could be appropriate in these types. However, control of competition with herbicides, and timing of prescribed fire are key factors in survival and growth of the planted pines. Although survival and growth of shortleaf and pitch pine will be the major focus in these types, some advanced oak regeneration is desirable, so pre-harvest burning would favor an oak component. As in the oak-hickory forest, without fire, dogwood, red maple, blackgum, and shrubs often dominate young stands on these upland sites. Also, as in any

[4]Plantation Evaluation Performance reports show that stands have been reforested within 5 years. Stand inventory records show young stands as being adequately stocked.

forest type, once the young cohort is established, fire (and other disturbance) should be excluded for several years to allow growth of bark for protection of the cambium layer of young trees. In Arkansas "evidently 5-6 year old shortleaf pine regeneration is surviving cool winter burns.[5]" However, when burning at other times of the year, pine stands should be nearer to age 10.

Silviculture in Oak-Pine types on the Daniel Boone National Forest: These types are basically a transition between the two forest type groups described above. Silvicultural systems and site preparation methods would be the same. The method selected for an individual project would depend on which component (oak, or yellow pine) needed the greatest emphasis. In the past, these stands would be managed using natural regeneration in a fire-mediated system as in the dry-mesic or dry-xeric oak types. Pines would seed in from adjacent stands, often from higher ridges above. However, due to the lack of pine seed source, artificial regeneration of pine will most likely be prescribed, especially if in the dry-xeric conditions. Some of these stands that were formerly oak-pine types on mesic sites, that have lost the pine component, will most likely be allowed to develop as oak-hickory types.

Silviculture in Mixed Mesophytic types on the Daniel Boone National Forest: The clearcutting and the shelterwood method have proven to be effective in regeneration of the mixed mesophytic types on the Forest[6]. With the right conditions, the seed tree method may also be successful in regenerating some of the light-seeded tree species such as yellow-poplar, within this type. However, in this Plan, much of this type is in the Riparian-Aquatic Area, which may be moving toward an old-growth condition. A small portion of the area is planned to have a routinely disturbed uneven-aged condition having much growth concentrated in the understory. Uneven-aged systems generally favor shade-tolerant species. In the mixed mesophytic type, species such as American beech, American basswood, and sugar maple would be favored. Very little yellow-poplar or walnut regeneration would be expected in the shady understory. If a seed source is present, a minor component of white pine and/or hemlock could become established. If the overstory is kept low, ash, and other intermediate shade tolerant species could emerge.

Since higher moisture conditions on these sites typically limit the use of fire as a site preparation tool, oak and pine regeneration is normally limited. High moisture conditions also limit the use of mechanical site preparation methods. A combination of manual and limited chemical site preparation methods will likely be the most appropriate applied method in this type. On these highly productive sites, a combination of overstory thinning and herbicide may be used within 10 years of final harvest to stimulate advanced oak regeneration (Loftis, 1990). In these highly productive (high growth) areas, shrub and vine species may need to be controlled using combinations of manual and herbicide methods in order to allow timely forest regeneration.

[5]Personal communication with Jim Guldin, Professor, Univ. of Arkansas, Monticello, 10/20/1997.

[6]Hardwood Stocking Surveys show that stands have been reforested within 5 years. Stand inventory records show young stands as being adequately stocked.

Silviculture in White pine & Hemlock types on the Daniel Boone National Forest: The clearcutting and the shelterwood method have shown mixed results in the regeneration of the white pine and hemlock types on the Forest. Hardwoods and shrubs often out-compete softwoods in full sunlight on mesic sites where this type is most appropriate. However, where hardwood competition is minimal, even-aged regeneration of these species may occur. The seed tree method could also be successful in regenerating white pine, if competition is controlled. However in this Plan, much of this type is in the Riparian-Aquatic Area, and will be moving toward an old-growth condition. A small portion of the area is planned as having a routinely disturbed uneven-aged condition having much growth concentrated in the understory. Uneven-aged systems generally favor both of these shade-tolerant softwood species. The hardwood component of these types, if any would respond as in the mixed mesophytic type above.

Since higher moisture conditions on these sites typically limit the use of fire as a site preparation tool, oak and pine regeneration is normally limited. High moisture conditions also limit the use of mechanical site preparation methods. Some herbicide use may be appropriate in non-riparian areas, however manual site preparation methods will likely be the most appropriate applied method in this type. In these highly productive areas, shrub and vine species may need to be controlled using combinations of manual and herbicide methods in order to allow softwood regeneration.

SUMMARY OF VEGETATION MANAGEMENT PRACTICES

When management alters vegetation, the methods, timing, and intensity of the practices determine the level of benefits that can be obtained from the affected resources. It is not practical to attempt to describe all the conditions and reasons for manipulating vegetative conditions. Reasons range from improving forest health to eliminating hazards for public safety. Site-specific implementation of the forest plan is the appropriate place for determining which management practice(s) to use for achieving a specific project objective. Table H - 1 identifies, by forest type group, the management practices that are effective treatment methods for the vegetation types on the Daniel Boone National Forest.

Table H - 1. Vegetation management practices on the Daniel Boone National Forest, by forest type group and two non-forest conditions

Vegetation Management Practice Description	Dry Xeric & Dry –Mesic Oak-Hickory	Yellow Pine & Yellow Pine-Hardwood	Oak-Pine	Mixed Mesophytic	White Pine & Hemlock	Grass-Shrub Opening	Road & Utility Right of Ways
Even-aged systems							
Shelterwood	X	X	X	X	X		
Clearcut	X	X	X	X	X		
Seed Tree		X	X		X		
Two-aged systems							
Shelterwood w. Reserves	X	X	X	X	X		
Seed Tree w. Reserves		X	X		X		
Uneven-aged systems							
Singletree selection	X	X	X	X	X		
Group selection	X	X	X	X	X		
Intermediate Treatments							
Thinning	X	X	X	X	X		
Pruning	X	X	X	X	X		
Seeding	X	X	X	X	X	X	X
Planting trees	X	X	X	X	X		X
Sanitation/Cleaning	X	X	X	X	X		
Salvage	X	X	X	X	X		
Prescribed fire	X	X	X	X	X	X	X
Mechanical Piling		X	X			X	
Mechanical Ripping		X	X				X
Mechanical Shearing							
Mechanical Grinding	X	X	X	X	X		X
Mechanical Chopping	X	X	X	X	X		X
Mechanical Scarifying		X	X				
Mechanical Mowing						X	X
Mechanical Disking		X	X			X	X
Herbicide Aerial Liquid	X	X	X	X	X	X	X
Herbicide Aerial Granular	X	X	X	X	X	X	X
Herbicide Mechanical Liquid	X	X	X	X	X	X	X
Herbicide Mechanical Granular	X	X	X	X	X	X	X
Herbicide Manual Granular	X	X	X	X	X	X	X
Herbicide Foliar Broadcast	X	X	X	X	X	X	X
Herbicide Basal	X	X	X	X	X	X	X
Herbicide Soil Spot	X	X	X	X	X	X	X
Herbicide Cut-Surface	X	X	X	X	X	X	X

“X” indicates that vegetation practice is effective.

Snow on the hemlocks, Stearns Ranger District.